HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF
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Vaccination against Typhoid Fever, Cholera, and Pest—It will be remembered that Wright some years ago introduced vaccination against typhoid fever in the British Army. At the outbreak of the Boer war a considerable number of troops had been vaccinated, and it was hoped that the medical record of that campaign would supply definite information concerning the value of this prophylactic measure. But there were so many disturbing factors influencing the health of the troops and the hospital records, that this hope was not realized. At the close of the South African War vaccination against typhoid fever was discontinued among British soldiers, but later it was taken up again and referred to a commission. LEISHMAN (*Berichte über den XIV Internationalen Kongress f. Hygiene und Dermographie*, ii, 536) has made a preliminary report upon the work and observations of this commission. The vaccine consists of cultures of the typhoid bacillus in meat and broth. These are sterilized, when from twenty-four to forty-eight hours old, at a temperature of 53°, maintained for one hour. The strains used are old, and are possessed of but slight virulence. These sterilized cultures are preserved by the addition of 0.25 per cent. of lysol, and are standardized by an enumeration of the number of bacteria in a given volume of the vaccine. When possible two inoculations are made, the first of 500,000,000, and the second of 1,000,000,000 bacteria, with an interval of ten days. This means, as a rule, 0.5 c.c. for the first and 1 c.c. for the second injection. The site of the injection is either the pectoral region or the outer surface of the upper arm at the insertion of the deltoid. The inoculations are made in the afternoon, and as a rule those treated are returned to duty on the second day afterward. The results of these inoculations in seven large Indian stations during the six months from January 1 to June 30, 1907, are shown in the following table:

	Mean strength.	Cases.	Deaths.	Incidence per 1000.	Mortality per 1000.
Non-inoculated	8113	173	42	21.32	5.18
Inoculated	2207	15	3	6.80	1.36

MUSEHOLD (*Ibid.*, 545) reports upon typhoid fever vaccination in the German army. The German vaccine is prepared by adding a normal loop (2 mg.) to each 0.5 c.c. of normal salt solution, and this is sterilized at 60°. Three inoculations are made. At first these consisted of 0.5, 1, and 1.5 c.c. of the vaccine, or 1, 2, and 3 loopfuls of the agar culture, but the reactions that followed these treatments were in some instances so serious that the dose was diminished and those now given are 0.4, 0.8, and 1.2 c.c.

The symptoms that follow these inoculations are fairly uniform. Within a few hours there is a chill, followed by fever and vomiting.

The temperature may go as high as 41°, though generally not more than 40°, and this is accompanied by albuminuria and cylindruria. The use of alcohol following the inoculation is forbidden, as it has been found to intensify and prolong the symptoms. Among more than 8000 vaccinated no lasting harm has been observed. Only those who are willing to do so are submitted to these preventive inoculations. The results of these inoculations seem to be beneficial, as shown by both the morbidity and mortality reports. The number of cases per thousand among the inoculated is 98.4. The beneficial effect on the course of the disease is shown by dividing the cases into (1) the fatal, (2) the severe, (3) the moderate, and (4) the light, such grouping showing the following:

In the inoculated per thousand	3.3 : 8.9 : 13.2 : 25.5
Or as	1 : 2.7 : 4.0 : 7.7
In the uninoculated per thousand	12.6 : 25.4 : 24.4 : 36.2
Or as	1 : 2.0 : 1.9 : 2.9

STRONG (*Ibid.*, 1085) finds that vaccination with dead pest bacilli or with bacillary extracts gives practically no immunity in the lower animals, and he is using in Manila a living non-virulent culture. In experimental animals these inoculations induce a fair degree of immunity, and in a small epidemic the deaths among the inoculated was 66.6 per cent., while among the vaccinated it was only 16.6 per cent. However, the number of the vaccinated exposed in this epidemic was too small to justify any positive conclusions. The size of the dose employed is one suspended twenty-four-hour agar start for adults, and from one-third to one-half this quantity in children. Strange to say, injections of these large amounts cause no severe reactions. The fact that the culture remains avirulent is determined from time to time by animal tests. Experiments on monkeys show that the avirulent pest bacilli are found quite abundantly in the tissue about the point of inoculation for from six to eight hours, after which time they gradually diminish, and after twenty-four hours they are seldom detectable. Strong holds that his method of inoculation for pest is a true vaccination, "the organism reproducing itself in the tissues for probably one hundred or more generations, and its successive groups of receptors stimulating the production of corresponding groups of amboceptors in the animal body."

In inoculating against cholera Strong injects 1 c.c. of the extract from virulent bacteria made according to the methods of Brieger and Neisser and of Shiga and Wassermann. He has treated over 6000 people by this method, and concludes that from a single inoculation a higher immunity can be obtained by this prophylactic than by any other.

PFEIFFER (*Ibid.*, 1071) discusses vaccination against typhoid fever, pest, and cholera. In the first place he speaks of the preparation of the vaccine. He states that not every culture is suitable or this purpose. In order to have a good cholera vaccine it is necessary to have a highly virulent culture. With typhoid fever the question of suitability of the culture is much more complicated, for, as Wassermann says, it is not the virulence of the culture so much as the affinity of the bacilli for the specific amboceptors that must be regarded as the determining factor; therefore the preferable culture is the one that absorbs from an immune serum the greatest amount of the anti-bodies. This can be determined only empirically on either men or animals, and the culture that induces the most marked specific changes in the blood should be selected. It is probably better still to employ a culture of mixed strains. The vaccine of Pfeiffer and Kolle is prepared by adding the growth on agar cultures to physiological salt solution and sterilizing at 60°; that of Wright by sterilizing young cultures at 60° (this has been changed by the commission, as has been stated, to heating for one hour at 50°); that of Löffler by drying the cell substance at from 120° to 150°; that of Macfayden and Rowland by rubbing up or grinding the bacilli at the temperature of liquid air; that of Neisser and Shiga, also that of Wassermann, by sterilization at 60°, and subsequent autolysis for five days at 37.3°; when the culture is filtered through porcelain, after which the filtrate may be used directly (method of Neisser and Shiga), or it may be evaporated in vacuo and the dry residue employed (the method of Wassermann); that of Brieger, Conradi and Meyer, by suspending the living bacillus in distilled water, shaking vigorously for three days, and filtering through porcelain. Pfeiffer is inclined to the belief that the dose of the vaccine should be large enough to induce slight toxic effects. Subcutaneous injections are safer than intravenous ones, and in most instances the former are preferable, although a higher degree of immunity may be obtained with smaller does intravenously. Two or three inoculations at intervals of from five to eight days are recommended as preferable to single ones. For typhoid fever, Löffler seeks to induce local intestinal immunity by long-continued administration of dead bacilli per os, and he has succeeded by this method experimentally in immunizing field mice to mouse typhoid. The possibility of developing a negative phase by vaccination is a question of the greatest importance. Pfeiffer is inclined, from his experimental work on animals, to deny that vaccination is followed by a negative phase, but he is cautious in his statements on this point. The work of Bail with his aggressins and that done with the typhoid residue in this country, certainly suggest the possibility of using the vaccine in too large doses; however, this would be much less likely to happen with the insoluble germ substance than with the soluble aggressins and residues. But the latter must prove to be the more suitable vaccines on account of their solubility, their ready diffusibility, and because they induce no toxic effect. It seems that even the most scientific men are slow to believe that any protective or curative agent can be of service to the body unless its administration is followed by some recognizable toxic effect.

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